REMARKS

The Advisory Action was issued in response to Applicant's Response B to the Office Action mailed April 23, 2004 (the "Office Action"). In the Advisory Action, the Examiner refused to enter the Applicant's proposed amendments maintaining that the amendments raised new issues that require further consideration.

In the Office Action, claims 1, 3-8, 11, 13 and 19-23 were rejected under 35 U.S.C. §112, second paragraph. Claims 1, 3-8, 11-15, and 19-23, were rejected under 35 U.S.C.§103(a). Applicants have canceled claims 15 and 19-23 and therefore, the Examiner's rejections with regard to these claims are not addressed in this Response.

I. RESPONSE TO REJECTIONS UNDER 35 U.S.C. §112, SECOND PARAGRAPH

In paragraph 3 of the Office Action, the Examiner rejected claims 1, 3-8, 11, 13 and 19-23 under 35 U.S.C. §112, second paragraph.

A. Independent Claim 1

The Examiner rejected claim 1 because "it is unclear as to how ... the rotational drive [is] housed within a base." Applicants have amended claim 1 to clarify that the "rotational drive [is] mounted to said base." Amended claim 1 meets the requirements set forth under 35 U.S.C. §112, second paragraph. Therefore, Applicants request the Examiner to remove this rejection.

B. Dependent Claim 3

The Examiner rejected claim 3 because it depended from cancelled claim 2. Applicants have amended claim 3 to depend from claim 1. Amended claim 3 meets the requirements set forth under 35 U.S.C. §112, second paragraph. Therefore, Applicants request the Examiner to remove this rejection.

C. Dependent Claims 4-8

Dependent claims 4-8 depend directly or indirectly from independent claim 1. These dependent claims include all of the limitations of the independent claim from which they depend. Applicants respectfully assert that dependent claims 4-8 are allowable for at least the reasons set forth above concerning independent claim 1.

D. Independent Claim 11

The Examiner rejected claim 11 because "it is unclear how ... a rotational drive [is] seated within a bore." Applicants have amended claim 11 to clarify that the "rotational drive [is] mounted to said base." Amended claim 11 meets the requirements set forth under 35 U.S.C. §112, second paragraph. Therefore, Applicants request the Examiner to remove this rejection.

E. Dependent Claim 13

Dependent claim 13 depends directly or indirectly from independent claim 11. This dependent claim includes all of the limitations of the independent claim from which it depends. Applicants respectfully assert that dependent claim 13 is allowable for at least the reasons set forth above concerning independent claim 11.

II. RESPONSE TO REJECTIONS UNDER 35 U.S.C. §103(a)

In paragraphs 5-8 of the Office Action, the Examiner rejected claims 1, 3-8, 11-15 and 19-23 under 35 U.S.C. §103(a) as being unpatentable over several combinations of the following patents:

- U.S. Patent No. 5,928,390 issued to Yaegashi et al. (*"Yaegashi"*);
- U.S. Patent No. 6,099,643 issued to Ohtani et al. ("*Ohtani*");
- U.S. Patent No. 5,794,487 issued to Solomon et al. ("*Solomon*"); and
- U.S. Patent No. 4,770,590 issued to Hugues et al. ("*Hugues*").

Fig. 1 of *Yaegashi* illustrates "a vertically movable main wafer transfer mechanism 21 [that] is provided in a central part of the process station 20." *Yaegashi*, 6: 11-13. "The main wafer transfer mechanism 21 has a columnar support body 70 comprising a pair of mutually facing vertical wall portion 71 and 72 coupled to each other at their upper and lower ends." *Yaegashi*, 9:49-52; Fig. 7. The lower end of the body 70 "is coupled to a rotary shaft of a rotational drive motor 74." *Yaegashi*, 9:54-56. A rotational shaft 70a, extending from the upper end of the body 70, is pivotally secured to the frame of the process station 20. The support body 70 pivots about a theta-axis, which is defined by the longitudinal central axis of the rotational shaft 70a and rotary shaft of the motor 74. "A wafer transfer member 73 is disposed inside the support body 70 so as to be vertically movable (in direction Z)." *Yaegashi*, 9: 52-54. As shown

in Fig. 7 of *Yaegashi*, the theta-axis passes though the wafer transfer member 73 and is concentric with the z-axis.

Ohtani describes a substrate transport robot TC. Robot TC includes "an X-direction driving mechanism 20, a Z-direction (vertical) driving mechanism 30, a rotation mechanism 40 and an arm sliding mechanism 50." *Ohtani*, 8:7-10; Fig. 10. The X-direction driving mechanism 20 moves the robot TC "on rails along the X direction by normally and reversely rotating nut members which are fitted with screw shafts by motors." *Ohtani*, 8:14-16. The Z-direction driving mechanism 30 "utilize[s] stretch driving of a pantagraph structure." *Ohtani*, 8: 18-19. The rotation mechanisms and the arm sliding mechanisms "are adapted to rotate arms of the substrate transport robots TC and TH in horizontal planes and advancing/retreating the arms respectively." *Ohtani*, 8: 19-21.

Solomon describes a drive system for a conventional dual-link robotic arm 24. The robotic arm 24 has "a lower arm link 26, an upper arm link 28, and a hand or end effector 30." *Solomon*, 3: 9-11. In the Fig. 3 embodiment, each arm link 26, 28 includes "a high-density metallic or ceramic filter 170,172 ... mounted in the bottom wall 26' of the arm link or arm 'hub'." *Solomon*, 6: 45-47. The filters "provide a dense barrier against entry or exit of particles from the arm links." *Solomon*, 6: 47-48.

Hugues describes a wafer transfer module mechanism 29 that includes a paddle 33 to pick up and carry a wafer 35. The mechanism itself 29 is stationary. However, the paddle 33 "is movable in a vertical (Z) direction and in a radial (R) direction and in a rotational (theta) direction." *Hugues*, 4: 49-51.

Yaegashi* in view of *Ohtani

In the Office Action, the Examiner rejected claims 1, 3-6 and 11-15 under 35 U.S.C. 103(a) as being unpatentable over *Yaegashi* in view of *Ohtani*.

A. Independent Claim 1 Patently Distinguishes over *Yaegashi* in view of *Ohtani*

Claim 1, among other things, recites:

> "a rotational drive mounted to said base and affixed to said first end of said support column, said rotational drive adapted to rotate said support column about a longitudinal central axis of said support column, said longitudinal central axis defining a theta axis;

a z-axis drive housing having a base portion and an elongated body, said base portion mounted to said second end of said support column such that said rotational drive rotates said z-axis drive housing about said theta axis;

a z-axis drive assembly housed substantially within said elongated body, said z-axis drive assembly adapted to move between a first position and a second position along a second linear path, said second linear path **defining a z-axis that is offset from said theta axis**;" [emphasis added]

Fig. 7 of *Yaegashi* illustrates that the wafer transfer member 73 moves along a z-axis that is concentric with a theta-axis that the wafer transfer member 73 rotates about. Thus, *Yaegashi* does not teach or suggest "a z-axis that is offset from said theta axis."

The wafer handling robot recited in claim 1, which includes a theta-axis offset from the z-axis, provides several advantages over a conventional wafer robot (*e.g.*, robot 21 disclosed in *Yaegashi*). One such advantage includes an end effector having a greater maximum reach into a process tool. Fig. 27 of the present invention illustrates that the wafer engine recited in claim 1 may reach, for example, 350mm into a process tool while a conventional wafer handling robot may only extend 250mm into a process tool. This additional range (*e.g.*, 100mm) is possible, in part, because the offset between the z-axis and theta-axis allows the wafer engine recited in claim 1 to initially protrude further into the process tool than a conventional robot.

Another benefit to offsetting the z-axis and theta-axis includes the ability to maneuver the wafer engine recited in claim 1 within a smaller EFEM than is required for a conventional wafer handling robot (*e.g.*, robot 21 disclosed in *Yaegashi*). Fig. 27 of the present invention illustrates that the wafer engine recited in claim 1 maneuvers within an EFEM that provides, for example, 420mm clearance while a conventional wafer robot requires a 520mm clearance to maneuver within. A conventional wafer robot cannot operate in such a small volume EFEM. Space within a wafer fabrication facility is costly and the footprint size of equipment is at a premium. Thus, shrinking the footprint of the EFEM (*e.g.*, from 520mm to 420mm) allows a semiconductor manufacturer to install more EFEMs within a fabrication facility. Therefore, the wafer engine recited in claim 1 is not obvious over *Yaegashi*.

Moreover, the robot TC in *Ohtani* does not teach or suggest the elements missing in *Yaegashi*. Fig. 10 of *Ohtani* illustrates that the Z-direction driving mechanism 30 moves the sliding arm mechanism 50 vertically along a z-axis (shown as up and down arrows in Fig. 10). Fig. 10 also illustrates the theta axis that the sliding arm mechanism 50 rotates about. The z-axis

and the theta-axis are concentric – not offset. The robot in *Ohtani* therefore has the same disadvantages as the robot 21 disclosed in *Yaegashi*, Therefore, Applicants respectfully suggest that the wafer engine recited in claim 1 is not obvious over *Yaegashi* in view of *Ohtani*.

B. Dependent Claims 3-6 Patently Distinguish over *Yaegashi* in view of *Ohtani*

Dependent claims 3-6 depend directly or indirectly from independent claim 1. These dependent claims include all of the limitations of the independent claim from which they depend. Applicants respectfully assert that dependent claims 3-6 are allowable for at least the reasons set forth above concerning independent claim 1.

C. Independent Claim 11 Patently Distinguishes over *Yaegashi* in view of *Ohtani*

Claim 11, among other things, recites:

> "a rotational drive mounted to said base and affixed to said first end of said support column, said rotational drive adapted to rotate said support column about a longitudinal central axis of said support column, said longitudinal central axis defining a theta-axis;
>
> a substantially L-shaped z-axis drive housing having an elongated vertical body and a base portion affixed to said second end of said support column, said z-axis drive housing containing a z-axis drive assembly being adapted to move within said elongated vertical body along a second linear path, said second linear path defining a z-axis that is offset from and substantially parallel to said theta-axis;
>
> a z-axis drive housing having an elongated vertical body and a base portion extending substantially perpendicular from said elongated vertical body and affixed to said second end of said support column, said z-axis drive housing containing a z-axis drive assembly adapted to move within said elongated vertical body along a second linear path, said second linear path defining a z-axis that is offset from and substantially parallel to said theta-axis;"

As previously discussed above, neither the robot 21 disclosed in *Yaegashi* nor the robot TC disclosed in *Ohtani* teach or suggest have "a z-axis that is offset from and substantially parallel to said theta axis." Therefore, for at least the same reasons provided above with regard to claim 1, the wafer engine recited in claim 11 is not obvious over *Yaegashi* in view of *Ohtani*.

Moreover, neither the robot 21 disclosed in *Yaegashi* nor the robot TC disclosed in *Ohtani* teach or suggest "a substantially L-shaped z-axis drive housing." In contrast, the robot 21 disclosed in *Yaegashi* includes a "columnar support body 70 comprising a pair of mutually facing vertical wall portion 71 and 72 coupled to each other at their upper and lower ends."

Yaegashi, 9:49-52; Fig. 7. The "L-shaped z-axis drive housing" recited in claim 11 provides several advantages over the robot disclosed in *Yaegashi*. For example, the robot 21 in *Yaegashi* cannot rotate the end effector to face a wafer seated in a process tool until the robot 21 is fully positioned in front of the process tool opening. In contrast, the wafer engine recited in claim 1 may begin to rotate to the end effector to face a wafer as the wafer engine is aligning itself with the process tool opening (see Fig. 28, step 5, of the present invention). In other words, the wafer engine recited in claim 1 can make a tighter turn than the robot 21 in *Yaegashi*. If the robot 21 in *Yaegashi* attempted the turn in Fig. 28, step 5, the vertical wall 71 would strike the wall of the process tool and damage the robot. The robot TC disclosed in *Ohtani* has similar problems. Therefore, Applicants respectfully assert that the wafer engine recited in claim 11 is not obvious over *Yaegashi* in view of *Ohtani*.

D. Dependent Claim 13 Patently Distinguishes over *Yaegashi* in view of *Ohtani*

Dependent claim 13 depends directly or indirectly from independent claim 11. This dependent claim includes all of the limitations of the independent claim from which it depends. Applicants respectfully assert that dependent claim 13 is allowable for at least the reasons set forth above concerning independent claim 11.

Yaegashi* in view *Ohtani* and further in view of *Hugues

In the Office Action, the Examiner rejected claims 7 and 13 under 35 U.S.C. 103(a) as being unpatentable over *Yaegashi* in view *Ohtani* and further in view of *Hugues*.

A. Dependent Claim 7 Patently Distinguishes over *Yaegashi* in view of *Ohtani* and further in view of *Hugues*

Dependent claim 7 depends indirectly from independent claim 1. Claim 1, among other things, recites:

> "a rotational drive mounted to said base and affixed to said first end of said support column, said rotational drive adapted to rotate said support column about a longitudinal central axis of said support column, said longitudinal central axis defining a theta axis;
>
> a z-axis drive housing having a base portion and an elongated body, said base portion mounted to said second end of said support column such that said rotational drive rotates said z-axis drive housing about said theta axis;

a z-axis drive assembly housed substantially within said elongated body, said z-axis drive assembly adapted to move between a first position and a second position along a second linear path, said second linear path defining a z-axis that is offset from said theta axis;"

For at least the same reasons discussed above with regard to claim 1, Applicants respectfully assert that claim 7 is not obvious over *Yaegashi* in view of *Ohtani*. Moreover, *Hugues* does not provide the elements missing in *Yaegashi* and *Ohtani*. Therefore, Applicants respectfully suggest that the wafer engine recited in claim 7 is not obvious over *Yaegashi* in view *Ohtani* and further in view of *Hugues*.

B. Dependent Claim 13 Patently Distinguishes over *Yaegashi* in view of *Ohtani* and further in view of *Hugues*

Dependent claim 13 directly from independent claim 11. Claim 11, among other things, recites:

"a rotational drive mounted to said base and affixed to said first end of said support column, said rotational drive adapted to rotate said support column about a longitudinal central axis of said support column, said longitudinal central axis defining a theta-axis;

a substantially L-shaped z-axis drive housing having an elongated vertical body and a base portion affixed to said second end of said support column, said z-axis drive housing containing a z-axis drive assembly being adapted to move within said elongated vertical body along a second linear path, said second linear path defining a z-axis that is offset from and substantially parallel to said theta-axis;

a z-axis drive housing having an elongated vertical body and a base portion extending substantially perpendicular from said elongated vertical body and affixed to said second end of said support column, said z-axis drive housing containing a z-axis drive assembly adapted to move within said elongated vertical body along a second linear path, said second linear path defining a z-axis that is offset from and substantially parallel to said theta-axis;"

For at least the same reasons discussed above with regard to claim 11, Applicants respectfully assert that claim 13 is not obvious over *Yaegashi* in view of *Ohtani* and further in view of *Hugues*.

Yaegashi* in view of *Ohtani* and further in view of *Solomon

In the Office Action, the Examiner rejected claims 8 and 19-23 under 35 U.S.C. 103(a) as being unpatentable over *Yaegashi* in view of *Ohtani* and further in view of *Solomon*. Dependent Claim 8 depends directly from independent claim 1. Claim 1, among other things, recites:

> "a rotational drive mounted to said base and affixed to said first end of said support column, said rotational drive adapted to rotate said support column about a longitudinal central axis of said support column, said longitudinal central axis defining a theta axis;
>
> a z-axis drive housing having a base portion and an elongated body, said base portion mounted to said second end of said support column such that said rotational drive rotates said z-axis drive housing about said theta axis;
>
> a z-axis drive assembly housed substantially within said elongated body, said z-axis drive assembly adapted to move between a first position and a second position along a second linear path, said second linear path **defining a z-axis that is offset from said theta axis**;" [emphasis added]

For at least the same reasons previously discussed above with regard to claim 1, the wafer engine recited in claim 8 is not obvious over *Yaegashi* in view of *Ohtani*. Moreover, *Solomon* does not provide the elements missing in the combination of *Yaegashi* and *Ohtani*. *Solomon* describes a dual-link robot arm. One skilled in the art would not combine a dual-link robot arm with the robot 21 disclosed in *Yaegashi*. Therefore, Applicants respectfully assert that the wafer engine recited in claim 8 is not obvious over *Yaegashi* in view of *Ohtani* and further in view of *Solomon*.

Additional Remarks

The references cited by the Examiner but not relied upon have been reviewed, but are not believed to render the claims unpatentable, either singly or in combination.

In light of the above, it is respectfully submitted that all of the claims now pending in the subject patent application are allowable, and a Notice of Allowance is requested. The Examiner is respectfully requested to telephone the undersigned before an advisory action is issued in order to avoid any unnecessary filing of an appeal.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 50-0639 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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